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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/038,352	01/02/2002	Kurt G. Steiner	47071/MJM/A717	7046

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EXAMINER

NGUYEN, HA T

ART UNIT PAPER NUMBER

2812

DATE MAILED: 03/31/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/038,352

Applicant(s)

STEINER ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-17,26 and 27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-17,26 and 27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 10-23-02 has been entered and made of record (Paper No. 8).

Response to Amendment

2. In view of Applicants' cancellation of the claim, the rejection of claim 3 under 35 U.S.C. 102 has been rendered moot.

Applicants' arguments with regard to the rejections under 35 U.S.C. 102 or 103 have been fully considered, but they are not deemed to be persuasive. The response to these arguments will be incorporated in the modified ground of rejection given below.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103^o and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 4, 6, 11, 26, and 27 are rejected under 35 U.S.C. 103(0) as being unpatentable over Kudo (U. S. Patent 6420261).

[Claims 1, 26, and 27] Referring to Figs. 8A-8P and related text, Kudo discloses a semiconductor product comprising: a low-k dielectric layer 54 ; a nitrogen base layer 61 including N-H base groups capable of diffusing therefrom; an oxygen containing layer 55 interposed directly between said low k dielectric layer and said nitrogen base. But it does not disclose expressly that the nitrogen base layer is formed of nitrogen-doped silicon carbide. However, Kudo also discloses that silicon dioxide and silicon carbide are equivalent materials (See col. 9, lines 29-32) . It would have been obvious to use two materials performing the same function to perform the same. When SiC is combined with Si oxide as material for layer 55, the interface between layers 61 and 55 will contain nitrogen-doped silicon carbide.

[Claim 4] wherein said nitrogen base layer comprises one of a barrier layer film, an etch-stop layer, and a hardmask film (see col.12, lines 54-59);

[Claim 6] wherein said nitrogen base layer inherently comprises a surface of a further film (see col.11, lines 56-64); and

[Claim 11] wherein said low-k dielectric layer includes a dielectric constant less than 3.5 (see col. 6, line1-15 and par. bridging cols. 12 and 13).

Therefore, it would have been obvious to use Kudo's teaching to obtain the invention as specified in claims 1, 4, 6, 11, 26, and 27 .

6. Claims 2, 7, 9, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo in view of Huang et al. (U. S. Patent 6191028, hereinafter "Huang").

[Claims 2, 7 and 13] Referring to Figs. 8A-8P and related text, Kudo discloses a semiconductor product comprising: a barrier layer 53 formed over a substrate 51; a lower low-k dielectric layer 54; an etch stop layer 61 formed over said lower low-k dielectric layer; an upper low k dielectric layer 62 formed over said etch stop layer; a hardmask layer 63 disposed over said upper low k dielectric layer; and an oxide film 55 interposed between said lower low k dielectric layer and said etch stop layer. Kudo also discloses that silicon dioxide and silicon carbide are equivalent materials (See col. 9, lines 29-32) . It would have been obvious to use two materials performing the same function to perform the same. When SiC is combined with Si oxide as material for layer 55, the interface between layers 61 and 55 will contain nitrogen-doped silicon carbide. But it does not disclose expressly the oxide is a TEOS. However, the missing

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limitation is well known in the art because Huang discloses oxide can be equivalently formed from silane or TEOS (See col. 3, lines 23-26).

[Claims 9 and 14] Kudo also discloses Kudo also discloses that silicon dioxide and silicon carbide are interchangeable materials (See col. 9, lines 29-32) . It would have been obvious to use two materials performing the same function to perform the same. When SiC is combined with Si oxide as material for layer 55, the interface between layers 61 and 55 will contain nitrogen-doped silicon carbide and when silicon dioxide of layer 63 is replaced by silicon nitride then the limitations wherein said barrier layer comprise one of nitrogen base layer formed of nitrogen-doped silicon carbide and silicon nitride; and said etch-stop layer comprises the other of said nitrogen base layer formed of nitrogen-doped silicon carbide, and silicon nitride will be met (see col. 11, line 51-col.12, line 60).

Therefore, it would have been obvious to combine Kudo with Huang to obtain the invention as specified in claims 2, 7, 9, 13, and 14.

7. Claims 5, 8, 10, 12, and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kudo (or Kudo in view of Huang and further) in view of Liu et al. (U.S. Patent 6323121, hereinafter "Liu").

Kudo (or Kudo in view of Huang) discloses substantially the limitations of claims 5, 8, 10, 12, and 15-17, as shown above. Kudo also discloses a two tier-opening formed to extend through said hardmask layer, said upper dielectric layer, said barrier layer (or said etch stop layer), the forming of a photoresist in the opening, and the forming of a conductive material filling the opening (see Fig. 8K-8P, #65-67 and 70).

But it does not disclose expressly the opening also extend through the etch stop layer and the lower dielectric layer and the use of organo-silicate glass as low k dielectric material.

However, the missing limitation are well known in the art because Liu discloses these features (See Fig. 1F and col. 4, lines 28-64).

A person of ordinary skill is motivated to modify Kudo (or Kudo and Huang) with Liu to obtain flexible manufacturing method capable of using available material to accomplish desired features including better etch control .

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Therefore, it would have been obvious to combine (or Kudo and Huang) with Liu to obtain the invention as specified in claims 5, 8, 10, 12, and 15-17.

Conclusion

8. The prior art relevant to the disclosure of this application and not being used in the rejections.

US Patent 6251802 to Moore et al. for teaching the equivalence of Si nitride, material containing Si, N, and C or Si, O, and C as etch stop material.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

9. A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



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Ha Nguyen

Primary Examiner

3- 21- 03